

## PATENT ABSTRACTS OF JAPAN

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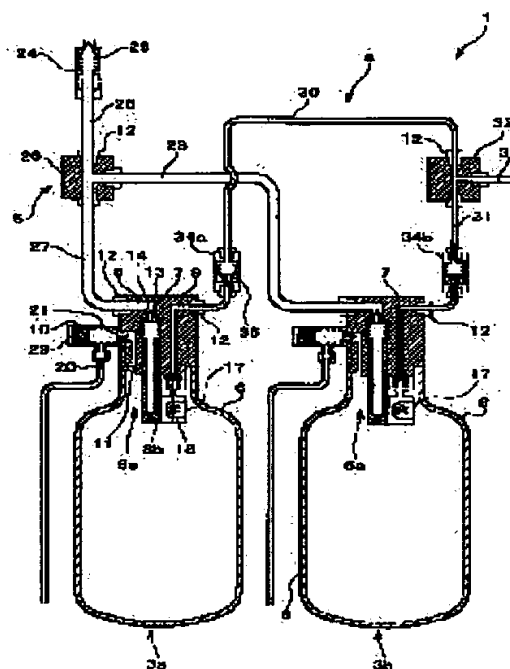
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## (54) HIGH PRESSURE GAS SUPPLY SYSTEM

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a configuration for preventing backflow of high pressure gas due to internal pressure difference caused among a plurality of high pressure containers.

**SOLUTION:** This high pressure gas supply system is provided with a supply line 4 for supplying high pressure gas from the high pressure containers 3a, 3b. The supply line 4 has a supply pipe 30 connected to the high pressure container 3a, a supply pipe 31 connected to the high pressure container 3b, and a pipe joining part 32 for joining the supply pipe 30 and the supply pipe 31. The supply pipe 30 is provided with a check valve 34a for establishing a passage when the internal pressure in the high pressure container 3a is higher than the pressure on the pipe joining part 32 side. The supply pipe 31 is provided with a check valve 34b for establishing a passage when the internal pressure in the high pressure container 3b is higher than the pressure on the pipe joining part 32 side.



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**CLAIMS**

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**[Claim(s)]**

**[Claim 1]** The supply line for having two or more high pressure vessels which can hold high pressure gas, and supplying said high pressure gas from said high pressure vessel, It is the high pressure gas distribution system equipped with the closing motion valve which controls closing motion of said high pressure vessel. Said supply line The high pressure gas distribution system characterized by having an antisuckback means to prevent that high pressure gas flows backwards to said high pressure vessel from said charging line connected to each of said high pressure vessel, the piping unification section which joins said charging line, and said piping unification section.

**[Claim 2]** Said antisuckback means is a high pressure gas distribution system according to claim 1 characterized by being the check valve prepared between said piping unification sections and said high pressure vessels or in said high pressure vessel.

**[Claim 3]** Said antisuckback means is a high pressure gas distribution system according to claim 1 or 2 characterized by being the cross valve prepared in said piping unification section.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]**

**[0001]**

**[Field of the Invention]** This invention relates to the high pressure gas distribution system which supplies the high pressure gas stored in the high pressure vessel to a

fuel cell etc.

[0002]

[Description of the Prior Art] The fuel cell electric vehicle attracts attention from the environmental side of controlling the discharge of the carbon dioxide leading to global warming in recent years. A fuel cell electric vehicle carries the fuel cell which hydrogen and the oxygen in air are made to react electrochemically, and generates them, supplies the electrical and electric equipment which the fuel cell generated to a motor, and is generating driving force. Since the hydrogen used for this fuel cell electric vehicle is easy handling compared with a liquid, the thing of a gaseous condition is used, and the high pressure vessel is used as that storage means. Moreover, although the hydrogen gaseous fuel automobile equipped with the internal combustion engine which burns hydrogen gas instead of a gasoline also attracts attention from the environmental side, since the same is said of this hydrogen gaseous fuel automobile, the high pressure vessel is carried.

[0003] The quality of the material of this high pressure vessel used plastics, such as polyethylene, as the base material from a viewpoint of lightweight-izing, and pressure resistance is secured by reinforcing this with a fiber. Moreover, a high pressure vessel is re-filled up with the hydrogen gas which decreased in number by use from the source of hydrogen gas supply installed in a hydrogen gas station like a gas station. In addition, two or more loading is carried out at one fuel cell electric vehicle, and the high pressure vessel has composition which can be supplied to a fuel cell in hydrogen gas from each high pressure vessel at alternative or coincidence.

[0004] Here, high pressure gas is supplied to a fuel cell etc. from such a high pressure vessel, or invention indicated by JP,8-177641,A is raised as a conventional example of the high pressure gas distribution system which fills up this high pressure vessel with high pressure gas. This high pressure gas distribution system has the high pressure gas distribution system which has the supply line which supplies high pressure gas to a fuel cell etc. from two high pressure vessels, and the charging line which fills up a high pressure vessel with high pressure gas, and has the composition of sharing the principal part of a supply line, and the principal part of a charging line. The configuration of the part mainly near a high pressure vessel has the configuration from which a charging line and a supply line differ, in this part, a charging line has piping equipped with the check valve, and the supply line has piping equipped with the closing motion valve. Furthermore, these piping is arranged at juxtaposition, supply of the high pressure gas to a fuel cell etc. is controlled by closing motion of a closing motion valve from a high pressure vessel, and restoration of the high pressure gas to a high

pressure vessel is controlled by the check valve. This high pressure gas distribution system has prevented that the high pressure gas with which the high pressure vessel was filled up flows backwards to the common area of a supply line and a charging line by the check valve. In addition, since piping equipped with the check valve and piping equipped with the closing motion valve are connected with high pressure gas after they join, the number of openings which a high pressure vessel has is one.

[0005]

[Problem(s) to be Solved by the Invention] However, in such a high pressure gas distribution system, when the internal pressure of one high pressure vessel was high and each closing motion valve was opened in the condition that the internal pressure of the high pressure vessel of another side is remarkable, and low, the high pressure gas in a high pressure vessel with high internal pressure might flow backwards rapidly in the high pressure vessel with low internal pressure through piping and a closing motion valve. Here, when high pressure gas contains many hydrogen gas, within a high pressure vessel with low internal pressure, generation of heat by the adiabatic compression of hydrogen gas and generation of heat by the expansion explained according to the Joule Thomson effect in addition to this mainly occur. Therefore, if high-pressure hydrogen gas flows backwards rapidly to a high pressure vessel with low internal pressure, the temperature in this high pressure vessel will rise rapidly, and will cause the problem of having bad effect on the equipment with which the high pressure vessel itself and the high pressure vessel were equipped. In addition, the temperature change of the gas at the time of a gas carrying out heat insulation irreversible expansion of the Joule Thomson effect is explained, and heat insulation irreversible expansion of hydrogen gas serves as an exoergic process in ordinary temperature. Moreover, when there was an internal pressure difference as mentioned above, even if it closed the closing motion valve of a high pressure vessel with low internal pressure, depending on differential pressure, the check valve may have carried out the same actuation as the time of restoration of high pressure gas, and may have changed into the open condition, and high pressure gas with a high pressure may have flowed backwards in the high pressure vessel with low internal pressure. Therefore, even if the technical problem which this invention tends to solve is the case where differential pressure is among two or more high pressure vessels with which it filled up with the high pressure gas which uses hydrogen gas as a principal component, it is preventing high pressure gas flowing backwards from a high pressure vessel with high internal pressure to a high pressure vessel with low internal pressure, and preventing the unnecessary temperature rise of a high pressure vessel.

[0006]

[Means for Solving the Problem] Invention concerning claim 1 of this invention which solves the aforementioned technical problem The supply line for having two or more high pressure vessels which can hold high pressure gas, and supplying high pressure gas from a high pressure vessel, It is the high pressure gas distribution system equipped with the closing motion valve which controls closing motion of a high pressure vessel. A supply line It considered as the configuration equipped with an antisuckback means to prevent that high pressure gas flows backwards to a high pressure vessel, from the charging line connected to each of a high pressure vessel, the piping unification section which joins a charging line, and the piping unification section.

[0007] The high pressure gas distribution system which has such a configuration becomes able [ the high pressure gas supplied from each high pressure vessel flow only in the specific direction ] to make it by establishing an antisuckback means. therefore -- for example, even if differential pressure is between the high pressure gas which two or more high pressure vessels are alike, respectively, and is held, high pressure gas with a high pressure should pass the piping unification section -- it can prevent certainly flowing backwards to a high pressure vessel with low internal pressure.

[0008] Moreover, invention concerning claim 2 of this invention used the antisuckback means as the check valve prepared between the piping unification section and high pressure vessels or in a high pressure vessel in the high pressure gas distribution system according to claim 1. A check valve can make the flow of the high pressure gas which is going to flow backwards a supply line certainly stop by preparing a check valve between the piping unification section and a high pressure vessel, since it has the configuration which passes the gas of only an one direction, even when differential pressure is in the high pressure gas in each high pressure vessel. Moreover, the same operation is done so even if it forms in the plug of a high pressure vessel etc., without preparing this check valve into piping.

[0009] Furthermore, invention concerning claim 3 of this invention used the antisuckback means as the cross valve prepared in the piping unification section in the high pressure gas distribution system according to claim 1 or 2. Since a cross valve has three ports which can connect piping and has the configuration which chooses one port from the two remaining ports, and is made to open for free passage to the specific port If a cross valve is prepared in the piping unification section, for example, piping of one can be chosen from piping of two connected to two high

pressure vessels in two or more high pressure vessels, and it can be made open for free passage with the one remaining piping. Therefore, since piping of the direction which was not chosen will be separated from the flow of high pressure gas, high pressure gas does not flow backwards for piping of the direction which was not chosen. In addition, by combining such a cross valve suitably, even if it is two or more high pressure vessels, it becomes possible to choose Rhine which supplies high pressure gas.

[0010]

[Embodiment of the Invention] The gestalt of operation of this invention is explained to a detail using a drawing. the schematic diagram of the fuel cell electric vehicle with which drawing 1 carried the high pressure gas distribution system in the gestalt of this operation -- it is -- drawing 2 -- the block diagram of a high pressure gas distribution system, and drawing 3 -- some high pressure vessels -- it is an enlarged drawing. As shown in drawing 1 , the high pressure gas distribution system 1 is carried in the fuel cell electric vehicle (henceforth an automobile) equipped with the fuel cell 2, equipped juxtaposition with two high pressure vessels 3a and 3b which can be filled up with high pressure gas, and is equipped with the supply line 4 for supplying high pressure gas to a fuel cell 2 from each high pressure vessels 3a and 3b, and the charging line 5 for filling up these high pressure vessels 3a and 3b with high pressure gas. In addition, in the gestalt of this operation, high pressure gas means gas with many contents of hydrogen gas and hydrogen gas, and natural gas (CNG:Compressed Natural Gas) is also contained. Moreover, a fuel cell 2 is generated using the electrochemical reaction of the hydrogen supplied from high pressure vessels 3a and 3b, and the oxygen in the air extracted from the open air, and the motor which is not illustrated is rotated. Moreover, it is also possible to carry the internal combustion engine which burns hydrogen gas and natural gas instead of a fuel cell 2.

[0011] Next, it explains, referring to drawing 2 and drawing 3 about each component of this high pressure gas distribution system 1. In addition, drawing 2 is an enlarged drawing a part and drawing 3 is drawing having shown the condition that high pressure vessel 3a supplied high pressure gas. As shown in drawing 2 , the high pressure gas distribution system 1 has two high pressure vessels 3a and 3b, the charging line 5 for filling each of high pressure vessels 3a and 3b up with high pressure gas, and the supply line 4 for supplying high pressure gas to a fuel cell 2 from each of high pressure vessels 3a and 3b. Moreover, the pressure gage which is not illustrated is formed in the supply line 4, and it is acting as the monitor of the capacity which the pressure of the high pressure gas supplied to a fuel cell 2, i.e., each of high pressure vessels 3a

and 3b, holds. In addition, a pressure gage can also be formed in the part near the high pressure vessels 3a and 3b of a supply line 4, and may be formed in a charging line 5.

[0012] High pressure vessels 3a and 3b have the same configuration, and have the body section 6 which carries out long duration hold of the high pressure gas, and the plug 7 which seals opening 6a prepared in the body section 6. Although these high pressure vessels 3a and 3b can be manufactured from metallic materials, such as steel, its so-called FRP (Fiber Reinforced Plastic) which reinforced plastics, such as polyethylene, with the fiber from a viewpoint of lightweight-izing is desirable.

Moreover, the volume and filling pressure of high pressure vessels 3a and 3b can be set up for every automobile. Furthermore, although two high pressure vessels 3a and 3b are shown in drawing 2, three or more are sufficient.

[0013] As shown in drawing 2 and drawing 3, the plug 7 has the open hole 11 for equipping with the relief valve 10 which opens the pressure in a high pressure vessel 3 to atmospheric air, when the restoration hole 8 for filling up high pressure vessels 3a and 3b with high pressure gas, the supply hole 9 for taking out high pressure gas from high pressure vessels 3a and 3b, and the temperature of a high pressure vessel 3 rise beyond a predetermined value. The restoration hole 8 is a hole which penetrates a plug 7, as the interior of high pressure vessels 3a and 3b and the outside of high pressure vessels 3a and 3b are opened for free passage, a joint 12 connects with a charging line 5, and, as for the other end side of the restoration hole 8, restoration pipe 8b is inserted by the end side (outside) of the restoration hole 8. Restoration pipe 8b is prolonged inside high pressure vessels 3a and 3b from the restoration hole 8, and has the configuration in which the diameter of opening at the tip decreases. Moreover, the check valve 13 is formed in the opening which the restoration hole 8 and restoration pipe 8b form, and it has prevented that the high pressure gas in high pressure vessel 3a and 3b flows backwards to a charging line 5.

[0014] In addition, as shown in drawing 3, the check valve 13 has the configuration by which a valve element 14 is energized towards level difference section 8a of the restoration hole 8 with a spring 15 from the interior side of a high pressure vessel 3. Therefore, if the high pressure gas in a charging line 5 becomes large rather than the high pressure gas in high pressure vessel 3a only in a predetermined pressure, a valve element 14 will move to the drawing 3 bottom, and high pressure gas will flow in high pressure vessel 3a and 3b from a charging line 5 side. On the other hand, when the difference of the pressure by the side of a charging line 5 and the pressure in high pressure vessel 3a is smaller than the force in which a spring 15 energizes a valve element 14, since a valve element 14 does not move contacting level difference



section 8a of the restoration hole 8, high pressure gas does not flow. It shall have other configurations and operations with the same said of a check valve henceforth.

[0015] Moreover, the supply hole 9 is a hole formed in the plug 7, as the interior of high pressure vessels 3a and 3b and the outside of high pressure vessels 3a and 3b are opened for free passage, and it is connected to the supply line 4 by the joint 12 in the edge of the outside of the supply hole 9. moreover, the electromagnetism which is a closing motion valve in the lower limit inside the high pressure vessels 3a and 3b of the supply hole 9 -- the latching valve 17 is formed. electromagnetism -- a latching valve 17 opens and closes the supply hole 9 by moving a valve element 19 in the vertical direction of drawing 2 with a solenoid coil 18. in addition, electromagnetism -- the location in which a latching valve 17 is formed -- the outside of a plug 7, and a supply line 4 -- on the way -- it can be alike and can also prepare. moreover, electromagnetism -- although a latching valve 17 can be used as other well-known latching valves, the so-called normally closed (normal close) mold is desirable so that supply of high pressure gas can be suspended at the time of un-working.

[0016] Furthermore, the relief valve 10 is formed in the outside, and, as for the open hole 11, the relief valve 10 is equipped with the piping 20 for disconnection. In drawing 3, the relief valve 10 has the configuration which energizes a valve element 21 with a spring 22 towards the inside of high pressure vessels 3a and 3b, and the meltable metal 23 is arranged by the other end side of a spring 22. Here, since the meltable metal 23 has the low melting point compared with other members, when the temperature of high pressure vessels 3a and 3b becomes an elevated temperature, the meltable metal 23 melts first. Therefore, in connection with the meltable metal 23 melting, a valve element 21 is pushed on high pressure gas, and high pressure gas is emitted to atmospheric air from the piping 20 for disconnection. Therefore, it can prevent that the internal pressure of the high pressure vessels 3a and 3b by the temperature rise turns into high pressure beyond a predetermined value.

[0017] Next, the charging line 5 and supply line 4 of the high pressure gas distribution system 1 are explained. As shown in drawing 2, the charging line 5 had the restoration piping 25 connected to the connection 24 for connecting with the source of supply which is not illustrated, and the connection 24, and the restoration piping 25 has branched in the piping tee 26 for the restoration piping 27 and 28 connected to each of high pressure vessels 3a and 3b. In addition, the connection 24 has the check valve 29 for preventing that the open air etc. goes into a charging line 5. Moreover, the supply line 4 has the piping unification section 32 which makes the charging lines 30 and 31 connected to each supply hole 9 of each high pressure vessels 3a and 3b, and

these two charging lines 30 and 31 join, and the supply line 4 after joining is connected to the fuel cell 2 of drawing 1 by the charging line 33. In addition, check valve 34a which is an antisuckback means is prepared in the charging line 30 before unification. This check valve 34a is arranged at the sense to which high pressure gas flows a charging line 30, only when the internal pressure of high pressure vessel 3a is higher than the pressure by the side of the piping unification section 32. Moreover, check valve 34b which is an antisuckback means is similarly prepared in the charging line 31. This check valve 34b is arranged at the sense to which high pressure gas flows a charging line 31, only when the internal pressure of high pressure vessel 3b is higher than the pressure by the side of the piping unification section 32. Therefore, it can prevent that high pressure gas flows backwards inside high pressure vessels 3a and 3b from the piping unification section 32 by these check valves 34a and 34b.

[0018] Next, the procedure filled up with high pressure gas using this high pressure gas distribution system 1 is explained. When the internal pressure of one of the high pressure vessels 3a and 3b or both becomes below a predetermined pressure value, since an alarm lamp lights up to the instrument panel of an automobile etc., an operator performs re-restoration of high pressure gas to high pressure vessels 3a and 3b at a high pressure gas supply station. In this case, the source of supply of a high pressure gas supply station and the connection 24 of the high pressure gas distribution system 1 are first connected by the well-known approach. And the bulb for supply by the side of a source of supply is opened wide, and high pressure gas is introduced into the charging line 5 of the high pressure gas distribution system 1. At this time, the pressure by the side of a source of supply is sufficiently high (former \*\* of a source of supply 50 MPa(s)) one compared with high pressure vessels 3a and 3b, and the check valve 13 in the plug 7 of high pressure vessels 3a and 3b is pushed towards the inside of high pressure vessels 3a and 3b. [ as opposed to / For example, the target filling pressure of high pressure vessels 3a and 3b 25 / MPa(s) ] Therefore, the restoration hole 8 of a plug 7 is open for free passage, high pressure gas flows in high pressure vessel 3a and 3b from a charging line 5, respectively, and re-restoration of high pressure gas is started.

[0019] If the pressure in high pressure vessel 3a and 3b becomes a predetermined value (for example, 25MPa), since the difference of the internal pressure of high pressure vessels 3a and 3b and the pressure by the side of a source of supply will become small, the valve element 14 of a check valve 13 is put back with a spring 15, and the restoration hole 8 is closed by the valve element 14. And discharge of connection of a source of supply and the high pressure gas distribution system 1

terminates re-restoration of the high pressure gas to high pressure vessels 3a and 3b. At this time, the pressure in high pressure vessel 3a and 3b is maintained by the check valve 13 in a plug 7. In addition, it fills up with high pressure gas when each internal pressure of the high pressure vessels 3a and 3b before restoration differs, for example, until each internal pressure of high pressure vessel 3a and high pressure vessel 3b becomes a predetermined value (for example, 25MPa(s)) since actuation of the check valve 13 in each plug 7 has the independent internal pressure of high pressure vessel 3a even if the internal pressure of 15MPa(s) and high pressure vessel 3b is 10MPa(s).

[0020] Furthermore, the case where high pressure gas is supplied to a fuel cell 2 is explained from the high pressure vessels 3a and 3b with which it filled up with high pressure gas in this way. the signal from the control unit which is not illustrated when supplying high pressure gas only from high pressure vessel 3a -- winning popularity -- the electromagnetism of high pressure vessel 3a -- only a latching valve 18 is changed into an open condition. Then, since the pressure by the side of the piping unification section 32 of a supply line 4 is low enough compared with the internal pressure of high pressure vessel 3a, the valve element 35 of check valve 34a of a charging line 30 is pushed by the high pressure gas supplied from the high pressure vessel 3, and since it is pushed up to the location shown in drawing 3 from the location shown in drawing 2 , passage is established in check valve 34a. Therefore, the high pressure gas in a high pressure vessel 3 flows in the direction shown in the arrow head of drawing 3 , and is further supplied to a fuel cell 2 through the piping unification section 32 and the charging line 33 which are shown in drawing 2 . Although high pressure gas flows also in a charging line 31 from the piping unification section 32 at this time, since check valve 34b of a charging line 31 does not establish passage even if the piping unification section 32 side becomes high pressure, the high pressure gas supplied from high pressure vessel 3a does not flow backwards to high pressure vessel 3b.

[0021] On the other hand, it is the same as that of the above also about the case where high pressure gas is supplied only from high pressure vessel 3b, and can prevent that the high pressure gas supplied by check valve 34a from high pressure vessel 3b flows backwards to high pressure vessel 3a. Since this means that the check valves 34a and 34b of the high pressure vessels 3a and 3b of the one where internal pressure is always higher will be in an open condition, and the check valves 34a and 34b of the high pressure vessels 3a and 3b of the one where internal pressure is lower will be in a closed state each electromagnetism of both high pressure vessels

3a and 3b -- even if it opens a latching valve 17 wide to coincidence, the high pressure gas from the high pressure vessels 3a and 3b of another side does not flow backwards to one of the high pressure vessels 3a and 3b. Moreover, when the internal pressure of high pressure vessel 3a and high pressure vessel 3b is comparable, both check valves 34a and 34b may be in an open condition at coincidence, but since internal pressure is comparable in this case and the back flow of high pressure gas hardly occurs, a problem is not produced.

[0022] If such a high pressure gas distribution system 1 is used, even if differential pressure is between two high pressure vessels 3a and 3b at the time of restoration of high pressure gas, or supply, it can prevent that high pressure gas flows backwards through a supply line 4 to the high pressure vessels 3a and 3b with low internal pressure from the high pressure vessels 3a and 3b with high internal pressure. Therefore, it can prevent that a high pressure vessel 3 becomes an elevated temperature by the exothermic phenomenon by the rapid back flow of high pressure gas. In addition, although check valves 34a and 34b were formed into a charging line 30 and 31 in drawing 2 and drawing 3, respectively, it is also possible to embed to each plug 7 of high pressure vessels 3a and 3b.

[0023] Next, the gestalt of another operation of the high pressure gas distribution system of this invention is explained using drawing 4. In addition, the sign same about the same component as drawing 2 is attached, and the explanation is omitted. As shown in drawing 4, the high pressure gas distribution system 41 has two high pressure vessels 3a and 3b, the charging line 5 for filling each of high pressure vessels 3a and 3b up with high pressure gas, and the supply line 4 for supplying high pressure gas to a fuel cell 2 from each of high pressure vessels 3a and 3b. Moreover, the pressure gage which is not illustrated for the high pressure gas distribution system 41 to act as the monitor of the pressure of high pressure gas is formed like the aforementioned example.

[0024] Here, the supply line 4 has two charging lines 30 and 31 connected to the supply hole 9 of each high pressure vessels 3a and 3b, and the charging line 32 which supplies high pressure gas to a fuel cell 2, and equips the piping unification section of charging lines 30, 31, and 32 with the cross valve 42 for making a charging line 33 open one of the charging lines 30 and 31 for free passage. A cross valve 42 is having port 42b by which the charging line's 31 was connected with port 42a to which the charging line's 30 was connected, and the port 43 where the charging line's 33 was connected, and moving a valve element with an actuator 44 here. It has the structure which can choose port 42a (charging line 30), connection of a port 43 (charging line 33), and

connection between port 42b (charging line 31) and a port 43 (charging line 33), and can be established.

[0025] Such a high pressure gas distribution system 41 serves as the configuration that only one of the high pressure vessels 3a and 3b supply high pressure gas to a fuel cell 2, by the change of a cross valve 42. Therefore, since a charging line 31 will be separated from these charging lines 30 and 33 when a charging line 30 and a charging line 33 are connected by the change of a cross valve 42 and high pressure gas does not flow to a charging line 31, the back flow of high pressure gas does not take place. Since similarly a charging line 30 will be separated from these charging lines 31 and 33 when a charging line 31 and a charging line 33 are connected by the change of a cross valve 42 and high pressure gas does not flow to a charging line 30, the back flow of high pressure gas does not take place. Therefore, in here, a cross valve 42 constitutes the antisuckback means of a publication in a claim.

[0026] In addition, this invention can be applied widely, without being limited to the gestalt of each aforementioned operation. For example, an antisuckback means may consist of check valves 34a and 34b prepared in each of the charging lines 30 and 31 shown in drawing 2 , and a cross valve 42 shown in drawing 3 . moreover, an antisuckback means -- between the piping unification section 32 of drawing 2 , and charging lines 30, and between the piping unification sections 32 and 31 -- respectively -- alike -- electromagnetism -- a latching valve -- preparing -- this electromagnetism -- it is good also as a configuration which chooses the high pressure vessels 3a and 3b which supply high pressure gas by changing closing motion of a latching valve. Furthermore, in the high pressure gas distribution system 41, it can respond also to the high pressure gas distribution system equipped with three or more high pressure vessel 3a by combining two or more cross valves 42 with a serial and juxtaposition. And as for the high pressure gas distribution systems 1 and 41, it is desirable to have a reducing valve for adjusting the pressure of the high pressure gas supplied to a fuel cell 2. Although preparing in a charging line 33 is desirable as for a reducing valve, it may be prepared in every each high pressure vessel 3a and 3b.

[0027]

[Effect of the Invention] In the high pressure gas distribution system which has the configuration whose this invention can supply high pressure gas from each of two or more high pressure vessels Since the high pressure gas which forms an antisuckback means to prevent the back flow of high pressure gas in a supply line, and is supplied from each high pressure vessel considered as the configuration which flows only in the specific direction Even if differential pressure is between the high pressure gas

held in each of two or more high pressure vessels, it can prevent certainly that high pressure gas with a high pressure flows backwards to a high pressure vessel with low internal pressure. Therefore, it can prevent that the temperature of high pressure gas and a high pressure vessel rises abruptly because the high pressure gas which is mainly concerned with hydrogen gas to a high pressure vessel with low internal pressure at the time of supply of high pressure gas flows backwards. If it is the check valve in which the antisuckback means was especially formed between the piping unification section and a high pressure vessel, the flow of the high pressure gas which is going to flow backwards a supply line can be made to certainly stop. Moreover, since an antisuckback means will become possible [ choosing Rhine where high pressure gas flows, and Rhine separated from the Rhine ] if it is used as the cross valve prepared in the piping unification section, it can prevent that high pressure gas flows backwards to Rhine of the direction which was not chosen.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the schematic diagram showing the fuel cell electric vehicle with which the high pressure gas distribution system of the gestalt of operation of this invention is carried.

[Drawing 2] It is the block diagram of the high pressure gas distribution system of a gestalt at operation of this invention.

[Drawing 3] It is the enlarged drawing showing the configuration of the plug of a high pressure vessel.

[Drawing 4] It is the block diagram of the high pressure gas distribution system in which the gestalt of another operation of this invention is shown.

[Description of Notations]

1 High Pressure Gas Distribution System

2 Fuel Cell

3a, 3b High pressure vessel

4 Supply Line

5 Charging Line

7 Plug

8 Restoration Hole  
9 Supply Hole  
10 Relief Valve  
11 Open Hole  
13 29 Check valve  
17 Electromagnetism -- Latching Valve (Closing Motion Valve)  
30, 31, 33 Charging line  
32 Piping Unification Section  
34a, 34b Check valve (antisuckback means)  
42 Cross Valve (Antisuckback Means)

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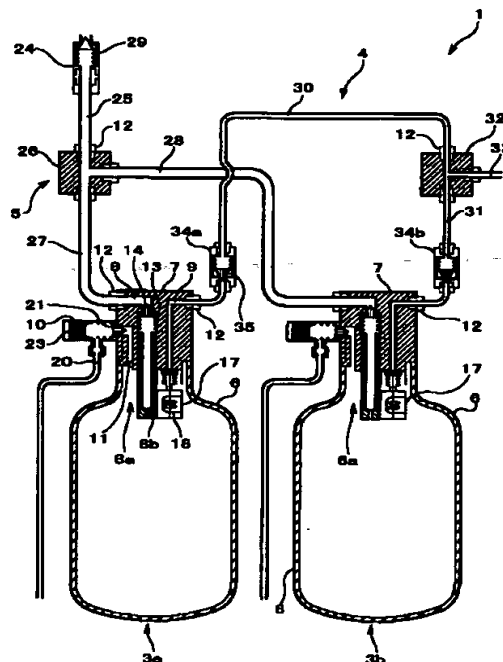
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(54) 【発明の名称】 高圧ガス供給システム

(57) 【要約】

【課題】 複数の高圧容器の間に生じた内圧差に起因する高圧ガスの逆流を防止する構成を提供する。

【解決手段】 高圧容器3 a、3 bから高圧ガスを供給する供給ライン4を備え、供給ライン4は、高圧容器3 aに接続された供給配管3 0と、高圧容器3 bに接続された供給配管3 1と、供給配管3 0および供給配管3 1を合流する配管合流部3 2を有し、供給配管3 0に高圧容器3 aの内圧が配管合流部3 2側の圧力よりも高い場合に流路を確立する逆止弁3 4 aを設け、供給配管3 1に高圧容器3 bの内圧が配管合流部3 2側の圧力よりも高い場合に流路を確立する逆止弁3 4 bを設けた。





## 【特許請求の範囲】

【請求項1】 高压ガスを収容可能な高压容器を複数有し、前記高压容器から前記高压ガスを供給するための供給ラインと、前記高压容器の開閉を制御する開閉弁を備えた高压ガス供給システムであって、前記供給ラインは、前記高压容器のそれぞれに接続された前記供給配管と、前記供給配管を合流する配管合流部と、前記配管合流部から前記高压容器に高压ガスが逆流することを防止する逆流防止手段を備えたことを特徴とする高压ガス供給システム。

【請求項2】 前記逆流防止手段は、前記配管合流部と前記高压容器の間、または、前記高压容器に設けられた逆止弁であることを特徴とする請求項1に記載の高压ガス供給システム。

【請求項3】 前記逆流防止手段は、前記配管合流部に設けられた三方弁であることを特徴とする請求項1または2に記載の高压ガス供給システム。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、高压容器に貯蔵した高压ガスを燃料電池等に供給する高压ガス供給システムに関する。

【0002】

【従来の技術】近年、地球温暖化の原因になる二酸化炭素の排出量を抑制するなどの環境面から、燃料電池電気自動車が目ざされている。燃料電池電気自動車は、水素と空気中の酸素を電気化学的に反応させて発電する燃料電池を搭載し、燃料電池が発電した電気をモータに供給して駆動力を発生させている。この燃料電池電気自動車に用いられる水素は、液体に比べて取り扱いが容易であることから気体の状態のものが用いられ、その貯蔵手段としては高压容器が用いられている。また、ガソリンの代わりに水素ガスを燃焼させる内燃機関を備えた水素ガス自動車も環境面から注目されているが、この水素ガス自動車も同様の理由から高压容器を搭載している。

【0003】この高压容器の材質は、軽量化の観点からポリエチレン等のプラスチックを母材とし、これをファイバで補強することで耐圧力を確保している。また、使用により減少した水素ガスは、例えば、ガソリンスタンドのような水素ガスステーションに設置された水素ガス供給源から高压容器に再充填される。なお、高压容器は一台の燃料電池電気自動車に複数搭載され、各高压容器から択一に、または、同時に水素ガスを燃料電池に供給可能な構成となっている。

【0004】ここで、このような高压容器から燃料電池等に高压ガスを供給したり、この高压容器に高压ガスを充填する高压ガス供給システムの従来例としては、特開平8-177641号公報に記載された発明があげられる。この高压ガス供給システムは、二つの高压容器から燃料電池等に高压ガスを供給する供給ラインと、高压容

器に高压ガスを充填する充填ラインとを有する高压ガス供給システムを有し、供給ラインの主要部と充填ラインの主要部を共有する構成となっている。充填ラインと供給ラインが異なる構成を有するのは、主に高压容器に近い部分の構成であり、この部分において充填ラインは、逆止弁を備えた配管を有し、供給ラインは、開閉弁を備えた配管を有している。さらに、これらの配管は並列に配置され、高压容器から燃料電池等への高压ガスの供給は、開閉弁の開閉により制御され、高压容器への高压ガスの充填は、逆止弁により制御される。この高压ガス供給システムは、逆止弁により、高压容器に充填された高压ガスが供給ラインと充填ラインの共有部分に逆流することを防止している。なお、逆止弁を備えた配管と、開閉弁を備えた配管は、合流した後に高压ガスと接続されているので、高压容器が有する開口部はひとつだけである。

【0005】

【発明が解決しようとする課題】しかしながら、このような高压ガス供給システムにおいて、一方の高压容器の内圧が高く、他方の高压容器の内圧が著しく低い状態で、それぞれの開閉弁を開放すると、内圧の高い高压容器内の高压ガスが、配管および開閉弁を通して内圧の低い高压容器内に急激に逆流してしまうことがあった。ここで、高压ガスが水素ガスを多く含んでいた場合には、内圧の低い高压容器内では、主に水素ガスの断熱圧縮による発熱と、その他、ジュールトムソン効果で説明される膨張による発熱が起きる。よって、内圧の低い高压容器に高压の水素ガスが急激に逆流すると、この高压容器内の温度が急激に上昇してしまい、高压容器自体や高压容器に備えられた機器類などに悪い影響を与えるという問題を引き起こす。なお、ジュールトムソン効果とは、気体が断熱不可逆膨張する際の気体の温度変化を説明するものであり、水素ガスの断熱不可逆膨張は、常温においては発熱過程となる。また、前記のように内圧差がある場合に、内圧の低い高压容器の開閉弁を閉じたとしても、圧力差によっては、逆止弁が高压ガスの充填時と同様の動作をして、開状態になり、内圧の低い高压容器内に圧力の高い高压ガスが逆流する可能性があった。従って、本発明が解決しようとする課題は、水素ガスを主成分とする高压ガスが充填された複数の高压容器の間に圧力差がある場合であっても、内圧の高い高压容器から内圧の低い高压容器に高压ガスが逆流することを防止し、高压容器の不必要な温度上昇を防止することである。

【0006】

【課題を解決するための手段】前記の課題を解決する本発明の請求項1に係る発明は、高压ガスを収容可能な高压容器を複数有し、高压容器から高压ガスを供給するための供給ラインと、高压容器の開閉を制御する開閉弁を備えた高压ガス供給システムであって、供給ラインは、高压容器のそれぞれに接続された供給配管と、供給配管

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を合流する配管合流部と、配管合流部から高压容器に高压ガスが逆流することを防止する逆流防止手段を備えた構成とした。

【0007】このような構成を有する高压ガス供給システムは、逆流防止手段を設けることで、各高压容器から供給される高压ガスが特定の方向にのみ流れるようにすることが可能となる。したがって、例えば、複数の高压容器のそれぞれに収容されている高压ガスの間に圧力差があっても、圧力の高い高压ガスが、配管合流部を経て、内圧の低い高压容器に逆流することを確実に防止できる。

【0008】また、本発明の請求項2に係る発明は、請求項1に記載の高压ガス供給システムにおいて、逆流防止手段は、配管合流部と高压容器の間、または、高压容器に設けられた逆止弁とした。逆止弁は、一方向のみのガスを流す構成を有しているため、配管合流部と高压容器の間に逆止弁を設けることで、各高压容器内の高压ガスに圧力差があった場合でも、供給ラインを逆流しようとする高压ガスの流れを確実にストップさせることができる。また、この逆止弁を配管中に設けずに高压容器のプラグ等に形成しても同様の作用を奏する。

【0009】さらに、本発明の請求項3に係る発明は、請求項1または請求項2に記載の高压ガス供給システムにおいて、逆流防止手段は、配管合流部に設けられた三方弁とした。三方弁は、配管を接続可能な3つのポートを有し、特定のポートに対して、残りの二つのポートから一つのポートを選択して連通させる構成を有しているため、配管合流部に三方弁を設けると、例えば、複数の高压容器のうちの二つの高压容器に接続された二本の配管から一本の配管を選択して、残りの一つの配管と連通させることができる。従って、選択されなかった方の配管は高压ガスの流れから切り離されることになるので、選択されなかった方の配管に高压ガスが逆流することはない。なお、このような三方弁を適宜組み合わせることで、二つ以上の高压容器であっても高压ガスを供給するラインを選択することが可能となる。

【0010】

【発明の実施の形態】本発明の実施の形態を図面を用いて詳細に説明する。図1は本実施の形態における高压ガス供給システムを搭載した燃料電池電気自動車の概略図であり、図2は高压ガス供給システムの構成図、図3は高压容器の一部拡大図である。図1に示すように、高压ガス供給システム1は、燃料電池2を備えた燃料電池電気自動車（以下、自動車という）に搭載されており、高压ガスを充填可能な二本の高压容器3a、3bを並列に備え、各高压容器3a、3bから燃料電池2に高压ガスを供給するための供給ライン4と、この高压容器3a、3bに高压ガスを充填するための充填ライン5とを備えている。なお、本実施の形態において、高压ガスとは、水素ガスおよび水素ガスの含有量が多いガスをいい、天

然ガス（CNG：Compressed Natural Gas）も含まれる。また、燃料電池2は、高压容器3a、3bから供給された水素と、外気から抽出した空気中の酸素の電気化学反応を利用して発電し、図示しないモータを回転させるものである。また、燃料電池2の代わりに水素ガスや天然ガスを燃焼させる内燃機関を搭載することも可能である。

【0011】次に、この高压ガス供給システム1の各構成要素について図2および図3を参照しながら説明する。なお、図3は、図2の一部拡大図であり、高压容器3aが高压ガスを供給している状態を示した図である。図2に示すように、高压ガス供給システム1は、二つの高压容器3a、3bと、高压容器3a、3bのそれぞれに高压ガスを充填するための充填ライン5と、高压容器3a、3bのそれぞれから高压ガスを燃料電池2に供給するための供給ライン4とを有している。また、供給ライン4には図示しない圧力計が設けられており、燃料電池2に供給される高压ガスの圧力、つまり、高压容器3a、3bのそれぞれが保有しているガス量をモニターしている。なお、圧力計は、供給ライン4の高压容器3a、3bに近い部分に設けることもできるし、充填ライン5に設けても良い。

【0012】高压容器3a、3bは、同じ構成を有しており、高压ガスを長時間収容する本体部6と、本体部6に設けられた開口6aを密閉するプラグ7とを有している。この高压容器3a、3bは、鉄鋼等の金属材料から製造することができるが、軽量化の観点からは、ポリエチレン等のプラスチックをファイバで補強した、いわゆるFRP（Fiber Reinforced Plastic）が好ましい。また、高压容器3a、3bの容積および充填圧力は自動車ごとに設定することが可能である。さらに、図2には高压容器3a、3bは二本示されているが、三本以上でも良い。

【0013】図2および図3に示すように、プラグ7は、高压ガスを高压容器3a、3bに充填するための充填穴8と、高压容器3a、3bから高压ガスを取り出すための供給穴9と、高压容器3の温度が所定値以上に上昇した場合に、高压容器3内の圧力を大気へ開放する安全弁10を装着するための開放穴11とを有している。充填穴8は、高压容器3a、3bの内部と高压容器3a、3bの外側を連通するようにプラグ7を貫通する穴であり、充填穴8の一端側（外側）は継手12により充填ライン5に接続され、充填穴8の他端側は充填パイプ8bが挿入されている。充填パイプ8bは、充填穴8から高压容器3a、3bの内側に延び、その先端の開口径が減少する構成を有している。また、充填穴8と充填パイプ8bとが形成する空隙には、逆止弁13が形成されており、高压容器3a、3b内の高压ガスが充填ライン5に逆流することを防止している。

【0014】なお、図3に示すように、逆止弁13は、

弁体14が高压容器3の内部側からパネ15で充填穴8の段差部8aに向けて付勢される構成を有している。従って、充填ライン5内の高压ガスが、高压容器3a内の高压ガスよりも所定圧力だけ大きくなると、弁体14が図3の下側に移動し、高压ガスが充填ライン5側から高压容器3a、3b内に流れる。一方、パネ15が弁体14を付勢する力よりも充填ライン5側の圧力と高压容器3a内の圧力の差が小さい場合は、弁体14は、充填穴8の段差部8aに当接したまま動かないので、高压ガスは流れない。以降において、他の逆止弁も同様の構成および作用を有するものとする。

【0015】また、供給穴9は、高压容器3a、3bの内部と、高压容器3a、3bの外側を連通するようにプラグ7に形成された穴であり、供給穴9の外側の端部において継手12により供給ライン4に接続されている。また、供給穴9の高压容器3a、3bの内側の下端には、開閉弁である電磁遮断弁17が設けられている。電磁遮断弁17は、ソレノイドコイル18により弁体19を図2の上下方向に移動させることで供給穴9を開閉するものである。なお、電磁遮断弁17を設ける場所は、プラグ7の外側や、供給ライン4の途中に設けることもできる。また、電磁遮断弁17はその他の公知の遮断弁とすることができるが、非稼動時に高压ガスの供給を停止できるように、いわゆる常閉（ノーマルクローズ）型が望ましい。

【0016】さらに、開放穴11は、その外側に安全弁10が設けられており、安全弁10には開放用の配管20が備え付けられている。図3において安全弁10は、高压容器3a、3bの内側に向けて弁体21をパネ22で付勢する構成を有しており、パネ22の他端側は、可溶金属23が配置されている。ここで、可溶金属23は他の部材に比べて低い融点を有しているので、高压容器3a、3bの温度が高温になった場合は、可溶金属23が最初に溶ける。従って、可溶金属23が溶けるのに伴い、弁体21が高压ガスに押され、開放用の配管20から高压ガスが大気へ放出される。従って、温度上昇による高压容器3a、3bの内圧が所定値以上の高压となることを防止できる。

【0017】次に、高压ガス供給システム1の充填ライン5および供給ライン4について説明する。図2に示すように、充填ライン5は、図示しない供給源に接続するための接続部24と、接続部24に接続された充填配管25を有し、充填配管25は、配管分岐部26において、高压容器3a、3bのそれぞれに接続された充填配管27、28に分岐している。なお、接続部24は、充填ライン5に外気等が入ることを防止するための逆止弁29を有している。また、供給ライン4は、各高压容器3a、3bのそれぞれの供給穴9に接続された供給配管30、31と、この二つの供給配管30、31を合流させる配管合流部32を有しており、合流した後の供給ラ

イン4は、供給配管33で図1の燃料電池2に接続されている。なお、合流前の供給配管30には逆流防止手段である逆止弁34aが設けられている。この逆止弁34aは高压容器3aの内圧が配管合流部32側の圧力よりも高い場合にのみ高压ガスが供給配管30を流れる向きに配置されている。また、同様に、供給配管31には逆流防止手段である逆止弁34bが設けられている。この逆止弁34bは高压容器3bの内圧が配管合流部32側の圧力よりも高い場合にのみ高压ガスが供給配管31を流れる向きに配置されている。従って、この逆止弁34a、34bにより配管合流部32から高压容器3a、3bの内部に高压ガスが逆流することを防止できる。

【0018】次に、この高压ガス供給システム1を用いて高压ガスを充填する手順について説明する。高压容器3a、3bのどちらか一方もしくは両方の内圧が所定圧力値以下になった場合は、自動車のインストルメントパネル等に警告灯が点灯するので運転者は、高压ガス供給ステーションで高压容器3a、3bに高压ガスの再充填を行う。この場合は、まず、高压ガス供給ステーションの供給源と高压ガス供給システム1の接続部24とを公知の方法で接続する。そして、供給源側の供給用バルブを開放して、高压ガス供給システム1の充填ライン5に高压ガスを導入する。このとき、供給源側の圧力は高压容器3a、3bに比べて十分高い（例えば、高压容器3a、3bの目標充填圧が25MPaに対して供給源の元圧が50MPa）ので、高压容器3a、3bのプラグ7内の逆止弁13は高压容器3a、3bの内側に向けて押される。従って、プラグ7の充填穴8が連通し、充填ライン5から高压ガスが高压容器3a、3b内にそれぞれ流れ、高压ガスの再充填が開始される。

【0019】高压容器3a、3b内の圧力が所定値（例えば、25MPa）になると、高压容器3a、3bの内圧と供給源側の圧力との差が小さくなるので、逆止弁13の弁体14がパネ15により押し戻されて、充填穴8が弁体14で閉じられる。そして、供給源と高压ガス供給システム1の接続を解除すると、高压容器3a、3bへの高压ガスの再充填が終了する。このとき、高压容器3a、3b内の圧力はプラグ7内の逆止弁13により保たれる。なお、充填作業前の高压容器3a、3bのそれぞれの内圧が異なる場合、例えば高压容器3aの内圧が15MPa、高压容器3bの内圧が10MPaであっても、それぞれのプラグ7内の逆止弁13の動作は独立なので、高压容器3aおよび高压容器3bのそれぞれの内圧が所定値（例えば25MPa）になるまで、高压ガスが充填される。

【0020】さらに、このように高压ガスが充填された高压容器3a、3bから燃料電池2に高压ガスを供給する場合について説明する。高压容器3aからのみ高压ガスを供給する場合は、図示しない制御装置からの信号を受けて、高压容器3aの電磁遮断弁18のみを開状態に

する。すると、供給ライン4の配管合流部32側の圧力は高压容器3aの内圧に比べて十分低いので、供給配管30の逆止弁34aの弁体35は、高压容器3から供給された高压ガスにより押され、図2に示す位置から図3に示す位置まで押し上げられるので、逆止弁34a内に流路が確立される。従って、高压容器3内の高压ガスは、図3の矢印に示す方向に流れ、さらに、図2に示す配管合流部32、供給配管33を経て、燃料電池2に供給される。このとき、高压ガスは、配管合流部32から供給配管31内にも流れるが、供給配管31の逆止弁34bは、配管合流部32側が高压になっても流路を確立しないので、高压容器3aから供給される高压ガスが高压容器3bに逆流することはない。

【0021】一方、高压容器3bからのみ高压ガスを供給する場合についても前記と同様であり、逆止弁34aにより高压容器3bから供給される高压ガスが高压容器3aに逆流することを防止できる。これは、常に内圧の高いほうの高压容器3a、3bの逆止弁34a、34bが開状態になり、内圧の低いほうの高压容器3a、3bの逆止弁34a、34bが閉状態になることを意味するので、両方の高压容器3a、3bのそれぞれの電磁遮断弁17を同時に開放しても、どちらか一方の高压容器3a、3bに他方の高压容器3a、3bからの高压ガスが逆流することはない。また、高压容器3aおよび高压容器3bの内圧が同程度の場合は、両方の逆止弁34a、34bが同時に開状態になることがあるが、この場合は内圧が同程度であるため高压ガスの逆流はほとんど起きないので問題は生じない。

【0022】このような高压ガス供給システム1を用いると、高压ガスの充填時もしくは供給時に、二つの高压容器3a、3bの間に圧力差があっても、内圧の高い高压容器3a、3bから供給ライン4を介して、内圧の低い高压容器3a、3bに高压ガスが逆流することを防止することができる。従って、高压ガスの急激な逆流による発熱現象で高压容器3が高温になることを防止できる。なお、図2および図3において逆止弁34a、34bは、それぞれ供給配管30、31中に設けたが、高压容器3a、3bのそれぞれのプラグ7に埋め込むことも可能である。

【0023】次に、本発明の高压ガス供給システムの別の実施の形態を図4を用いて説明する。なお、図2と同一の構成要素については同一の符号を付して、その説明を省略する。図4に示すように、高压ガス供給システム41は、二つの高压容器3a、3bと、高压容器3a、3bのそれぞれに高压ガスを充填するための充填ライン5と、高压容器3a、3bのそれぞれから高压ガスを燃料電池2に供給するための供給ライン4とを有している。また、前記の実施例と同様に高压ガス供給システム41は、高压ガスの圧力をモニターするための図示しない圧力計が設けられている。

【0024】ここで、供給ライン4は、各高压容器3a、3bの供給穴9に接続された二つの供給配管30、31と、燃料電池2に高压ガスを供給する供給配管32とを有しており、供給配管30、31、32の配管合流部には、供給配管30、31のどちらか一方を供給配管33に連通させるための三方弁42を備えている。ここで、三方弁42は、供給配管30が接続されたポート42aと、供給配管31が接続されたポート42b、ならびに、供給配管33が接続されたポート43を有し、アクチュエータ44で弁体を移動させることで、ポート42a（供給配管30）とポート43（供給配管33）の接続と、ポート42b（供給配管31）とポート43（供給配管33）との接続を選択して確立することができる構造を有するものである。

【0025】このような高压ガス供給システム41は、三方弁42の切り替えにより、どちらか一方の高压容器3a、3bのみが燃料電池2に高压ガスを供給する構成となる。従って、三方弁42の切り替えにより供給配管30と供給配管33とを接続した場合は、供給配管31はこれらの供給配管30、33から切り離されることになるので、供給配管31に高压ガスが流れることはないから、高压ガスの逆流は起こらない。同様に、三方弁42の切り替えにより供給配管31と供給配管33を接続した場合は、供給配管30はこれらの供給配管31、33から切り離されることになるので、供給配管30に高压ガスが流れることはないから、高压ガスの逆流は起こらない。従って、ここにおいて、三方弁42は、特許請求の範囲に記載の逆流防止手段を構成する。

【0026】なお、本発明は前記の各実施の形態に限定されずに広く応用することができる。例えば、逆流防止手段は、図2に示す供給配管30、31のそれぞれに設けられた逆止弁34a、34bと、図3に示す三方弁42とで構成しても良い。また、逆流防止手段は、図2の配管合流部32と供給配管30との間、および配管合流部32と31の間のそれぞれに電磁遮断弁を設け、この電磁遮断弁の開閉を切り替えることで高压ガスを供給する高压容器3a、3bを選択する構成としても良い。さらに、高压ガス供給システム41において、複数の三方弁42を直列や、並列に組み合わせることで、3本以上の高压容器3aを備えた高压ガス供給システムにも対応することができる。そして、高压ガス供給システム1、41は、燃料電池2に供給する高压ガスの圧力を調整するための減圧弁を備えることが望ましい。減圧弁は、供給配管33に設けることが好ましいが、各高压容器3a、3bごとに設けても良い。

【0027】

【発明の効果】本発明は、複数の高压容器のそれぞれから高压ガスを供給可能な構成を有する高压ガス供給システムにおいて、供給ラインに高压ガスの逆流を防止する逆流防止手段を設けて、各高压容器から供給される高压

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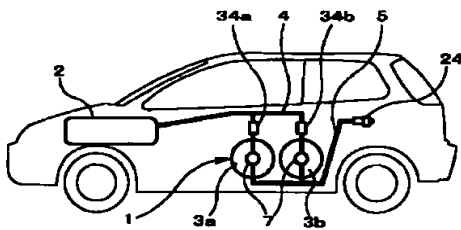
ガスが特定の方向にのみ流れる構成としたので、複数の高圧容器のそれぞれに収容されている高圧ガスの間に圧力差があっても、圧力の高い高圧ガスが、内圧の低い高圧容器に逆流することを確実に防止できる。従って、高圧ガスの供給時に、内圧の低い高圧容器に水素ガスを主とする高圧ガスが逆流することで、高圧ガスおよび高圧容器の温度が急上昇することを防止できる。特に、逆流防止手段を配管合流部と高圧容器の間に設けられた逆止弁とすると、供給ラインを逆流しようとする高圧ガスの流れを確実にストップさせることができる。また、逆流防止手段は、配管合流部に設けられた三方弁とすると高圧ガスが流れるラインと、そのラインから切り離されたラインを選択することが可能となるので、選択されなかった方のラインに高圧ガスが逆流することを防止できる。

【図面の簡単な説明】

【図1】本発明の実施の形態の高圧ガス供給システムが搭載される燃料電池電気自動車を示す概略図である。

【図2】本発明の実施形態の高圧ガス供給システムの構成図である。

【図1】



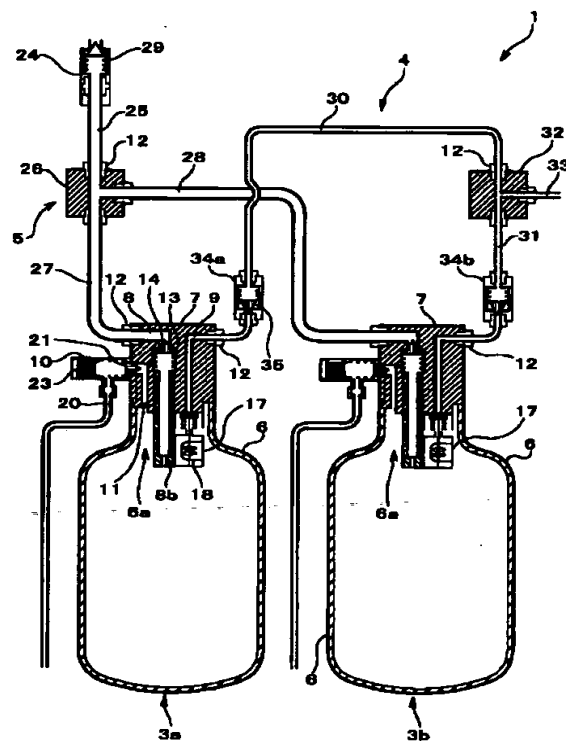
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\*【図3】高圧容器のプラグの構成を示す拡大図である。  
【図4】本発明の別の実施の形態を示す高圧ガス供給システムの構成図である。

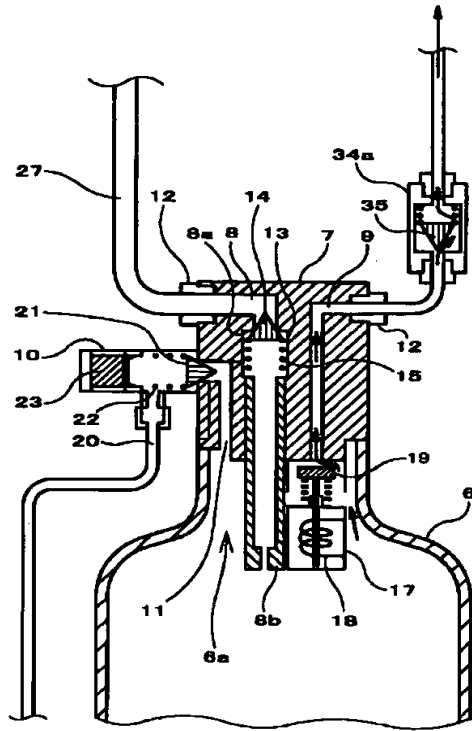
【符号の説明】

- 1 高圧ガス供給システム
- 2 燃料電池
- 3 a, 3 b 高圧容器
- 4 供給ライン
- 5 充填ライン
- 7 プラグ
- 8 充填穴
- 9 供給穴
- 10 安全弁
- 11 開放穴
- 13, 29 逆止弁
- 17 電磁遮断弁（開閉弁）
- 30, 31, 33 供給配管
- 32 配管合流部
- 34 a, 34 b 逆止弁（逆流防止手段）
- \*20 42 三方弁（逆流防止手段）

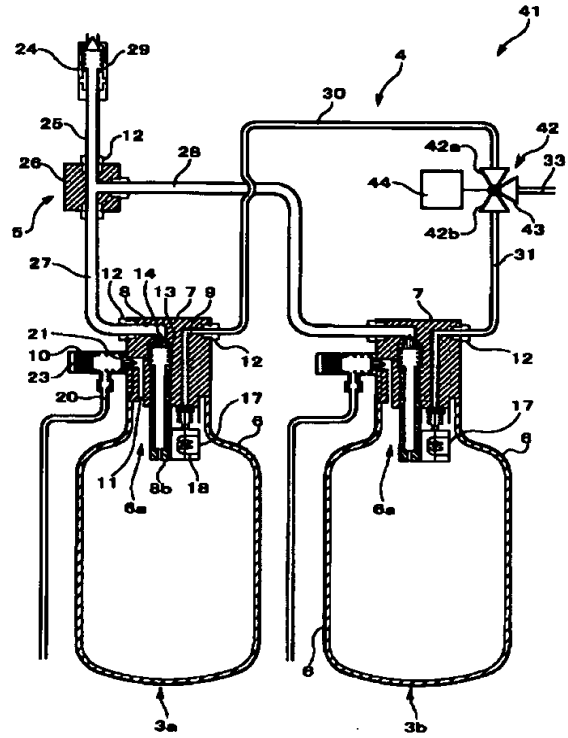
【図2】



【図3】



【図4】



フロントページの続き

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 3E072 DB03  
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